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SCIENTIFIC AFFAIRS

No. 651

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This serial report contains press and radio coverage on the development of and progress in the various theoretical and applied scientific disciplines and technical fields; and the administration, structure, personnel, and research plans of leading East European scientific organizations and institutions, particularly the academies of sciences.

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EAST EUROPE REPORT

SCIENTIFIC AFFAIRS

No. 651

CONTENTS PAGE

POLISH-CZECH SCIENTIFIC-TECHNICAL COOPERATION DESCRIBED

Warsaw ZYCIE GOSPODARCZE in Polish No 39, 30 Sep 79 p 13

[Text] In conformity with the principal directions of development of the national economy of both countries, the Polish-Czech scientific-technical cooperation is centered around the problems of expansion of the raw-material base, metallurgy, machine engineering, power industry, electronics, chemicsl industry, food industry and agriculture, light industry, and building engineering.

Within the framework of this cooperation the exchange is being carried out annually by over 4,500 specialists, and with over 500 important items of documentation, as well as of several hundred various patterns and prototypes. Likewise, several hundred scientific and research tasks are being solved jointly in accordance with long-range plans of cooperation and various contracts and agreements. For the most part, this cooperation revolves round the requirements resulting from the co-production and specialization in industrial production.

The Polish-Czech scientific-technical cooperation has yielded a number of valuable results in the form of economies of working capacities of the scientific research institutes and in financial outlays for scientific-research purposes, in starting production of new articles, specialized and cooperative production, intensification of the existing production, and economy in investment outlays of both countries.

The Polish-Czech scientific-technical cooperation has achieved the widest scope in the Ostrawa-Katowice Industrial Complex where the most important problems connected with coal mining, work safety in mines, development of metallurgy, regional planning, etc., are being solved jointly.

These Are Some Examples

As a result of scientific-research studies carried out jointly with Poles by the Ostroj Ostrava Enterprise in 1977, specialized production has been introduced, from which Poland is receiving deliveries valued at 108.5 million korunas annually.

Within the framework of bilateral scientific-technical cooperation with participation of Polish specialists, considerable injury to the blooming mill in the Klement Gottwald Metallurgical Combine has been eliminated, which made it possible to avoid the shutdowns and economize 29 million korunas. Here too, a technical preparation of the reconstruction of a blast furnace has been jointly solved through the exchange of its individual parts. Thanks to this, the repair time has been shortened by 74 hours and resulted in an economy of 2 million korunas. In the Trinec Steel Plant the problem of improvement of the agglomerate was solved in cooperation with Polish specialists and is yielding an additional production of agglomerate of 10,000 tons annually.

In 1978, important effects were achieved through a cooperative solution of problems relative to the intensification of production in the departments of metallurgy, viz.: a reduction in the consumption of coke by 30 percent per ton of steel, increase in steel production in oxygen converters, and the introduction by both partners of automatic control systems of metallurgical processes. The labor productivity of blast furnaces has been thereby increased by 2-3 percent, of steel production by 2-4 percent, and in rolling departments by 5-7 percent.

In the machine building industry, e.g., in 1977, the additional benefits achieved thanks to cooperation amounted to 14 million korunas, chiefly in the production of electronic devices, medical equipment, agricultural machinery and tractors.

The Tesla Association is cooperating with Polish partners in the field of the development of production of the active and passive subassemblies, light sources, electron tubes, and electronic receivers. Bilateral gains from this cooperation are estimated at about 3.5 million korunas. The cooperation results in increased co-production and specialization. For example, in accordance with the concluded agreement, by 1980 Czechoslovakia will supply Poland the electronic parts in the value of 120 million korunas. The five-year turnover in virtue of the agreement on specialization in the field of light sources will amount of 120 million korunas. Specialization on the part of Poland will also include push-buttons. Specialization in the field in question will permit a reduction in labor consumption of production by 5.5 percent and an increase in labor productivity by 3 percent. The developmental-research ccoperation is continuing and is creating conditions for a further expansion of specialization in production.

The scientific-technical cooperation of the Chirana Plant with Polish organizations in the field of x-ray techniques is developing satisfactorily. In the past year alone, the resulting economies amounted to 15,233 hours of designing for both parties. Within the framework of this cooperation the PRL has received complete documentation of the production of a VH oscillator and of an autotransformer, destined for the Chiralux device. The final tests and the establishment of technical parameters are taking place in Czechoslovakia. In turn, tests were performed in Poland for for Czechoslovakia on a diagnostic wall and a controller of an x-ray device. As a result of this cooperation, an agreement on co-production is in preparation.

A comprehensive agreement on research, elaboration and manufacture of a self-propelled chaff cutter-mower of the 2nd generation has been concluded between the Zbrojovka Brno Plant and the Polish "Agromet." The joint research and application work is proceeding very satisfactorily.

Cooperation in the field of communication is focused on planning and construction of the Wroclaw-Prague main cable line and the application of integrated communication systems. Optimization and coordination of the development of UHW and FM radio broadcasting network is being carried out.

The cooperation between the Elitex Association and the Polish partners in performing measurements on weaving and finishing machines is a very good example of scientific and technical cooperation. This cooperation has made it possible to ascertain the assortment of the machinery of this type produced in PRL and to ensure its delivery to Czechoslovakia.

In the field of agriculture, the methods of the fodder production in agricultural farms and modern technologies of cattle and hogs breeding and poultry farming, are being jointly worked out. A study is also being made on raising new varieties of wheat and rye of high yield per hectare and resistance to diseases and pests. The results of this cooperation contribute to the increase of the yield of crops and animal production in both countries.

One could quote many other examples of a successful scientific-research cooperation between Czechoslovakia and PRL. In most cases it produced very valuable effects on the development of national economy of both countries. There are, however, still many unexploited possibilities of expanding and intensifying this cooperation.

Therefore, already now consultations are being carried on at central administrative levels and themes are being prepared as subjects for cooperation in the years 1981-1985. The first stage of consultations established the "Main Directions of Scientific-Technical Cooperation Between Czechoslovakia and PRL for 1981-1985," covering the most important fields of science and technology of interest to both parties. The consistent implementation of the "Main Directions" in the form of specific agreements on cooperation in the entire cycle: research - elaboration - production - exploitation, will deepen the process of integration between Czechoslovakia and PRL.

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DETAILS ON MOS CIRCUITS, ELECTRONIC COMPONENTS REPORTED

Characteristics of MOS Circuits

East Berlin NACHRICHTENTECHNIK-ELEKTRONIK in German Vol 29 No 7, Jul 79 pp 304-305, manuscript received 4 Dec 1978

[Article by D. Borshukov: "MOS-Circuit Development in Bulgaria"]

[Text] At the present time, some series of highly integrated standard and customer-requested circuits in MOS technology are being developed at the Institute for Micro-Electronics. Among the standard circuits there are RAM's, ROM's and a set of microprocessor circuits. Customer-requested circuits are electronic computers, clock circuits and telephone circuits. Different MOS technologies are used for circuit development: p-channel technology with metal holes and microresistances (institute development for microcomputers of the Institute for Micro-Electronics), p- and n-channel technology with silicon-gate, p-channel technology with metal hole and ion implantation. The following tables list the characteristics and parameters of the MOS circuits produced and developed. The circuits marked with an asterisk are in the development stage.

Table 1. RAM's

Schaltkreis (a)	Typ (b)	Organisation (c)	Versorgungsspannung V (d)	Eingangspegel V (e) U_{IL}	U_{IH}	Ausgangspegel V (f) U_{OL}	U_{OH}	Leistung (g) mW	Zugriffszeit (h) µs	Lesezyklus (i) µs	Schreibzyklus µs (j)	Anzahl der Anschlüsse (k)	Technologie (l)
CM 8001 M	stat.	256×1	−9, +5	0,5	3	0,45	3,5	440	1 bis 1,5	1 bis 1,5	0,8	16	p-Si-Gate (o)
CM 8002	stat.	64×4	−15,	−7	−2,5	−14	−19,5	470	1,5	1,5	0,8	24	pµR[1]
CM 8102	stat.	1024×1	5,	0,65	2,5	0,45	2,2	370	0,5 bis 1	0,5 bis 1	0,5 bis 1	16	n-Si-Gate (o)
CM 8104												22	
CM 8111	stat.	256×4	5,	0,65	2,2	0,45	2,2	370	0,5	0,5	0,5	18	n-Si-Gate (o)
CM 8112												16	
CM 8101	dyn.	1024×1						180	0,090	0,180	0,160	22	n-Si-Gate (o)
CM 8107*	dyn.	4096×1	12,5, −5	TTL-kompatibel (m) außer Takt (n)				680	0,2		0,4 bis 0,6	22	n-Si-Gate
CM 8105*	stat.	4096×1	5	TTL-kompatibel (m)				220	0,2		0,3 bis 0,46	18	n-Si-Gate
CM 8116	dyn.	16384×1	12,5, −5	TTL-kompatibel				460	0,2		0,375	16	n-Si-Gate (o)

1) diffused-in ohm resistance

Table 2. ROMs

Schaltkreis (a) D		Organisation (c)	Versorgungsspannung V (d) U_{DD}	Eingangspegel V (e) U_{IL}	U_{IH}	Ausgangspegel V (f) U_{OL}	U_{OH}	Leistung mW (g)	Zugriffszeit µs (h)	Anzahl der Anschlüsse (k)	Technologie (l)
CM 7400	(p)	256×8	−9, +5	0,65	3	0,45	3,5	450	1	24	pµR
CM 7200	oder	10,24×4 512×8	−15	−7	−2,5	$U_{DD}+1$	1,5	375	1,5	24	pµR
CM 7300		512×12	−15	−7	−2,5	$U_{DD}+2$	1,5	300	5	24	pµR
CM 7600		1024×8	5	0,8	2	0,45	2,4	850	0,5	24	n-Si-Gate (o)
CM 7720* PROM		256×8 256×8	5, −9 −9	0,65	3	0,45	3,5	700	1	24	p-Si-Gate (o)

Key:
(a) circuit
(b) type
(c) organization
(d) supply voltage
(e) entry level
(f) exit level
(g) power
(h) access time
(i) reading time
(j) writing time
(k) number of corrections
(l) technology
(m) compatible
(n) out of time
(o) holes
(p) or

Table 3. Microprocessor Circuits

Schaltkreis (a)	Einsatzfunktion (b)	Versorgungsspannung V (c)	Eingangspegel V (d)		Ausgangspegel (e) V, mA				Frequenz (f) MHz	Leistung (g) W
			U_{IH}	U_{IL}	U_{OH}	U_{OL}	I_{OH}	I_{OL}		
CM 601[1])	Mikroprozessor (h)	5	2	– 0,3	2,4	0,4			1	1,2
CM 602	Paralleler Interfaceadapter (i)	5	2	– 0,3	2,4	0,5	– 10	1,6	1	0,650
CM 603[1])	Asynchroner Fernmeldeinterfaceadapter (j)	5	2	– 0,3	2,4	0,8			0,8	0,525
CM 604[1])	Modem 0 bis 600 Baud (k)	5	2	– 0,3	2,4	0,5	0,3			0,325
CM 605[1])	Synchroner serieller (l) Adapter für Daten (m)	5	2	– 0,3	2,4	0,5			0,6	0,525

1) n-Kanal-Silicon-Hole Technology

Key:
(a) circuit
(b) utilization
(c) supply voltage
(d) entry level
(e) exit level
(f) frequency
(g) power
(h) microprocessor
(i) parallel interface-adapter
(j) asynchronous telecommunication
(k) Modem 0 to 600 Baud
(l) synchronous serial
(m) adapter for data

Table 4. Computer Circuits

Circuit	Function	Supply voltage	Power mW	Indicator Digitron	Indicator LED	Printer	No. of connections
CM 103	Four basic computation types $\sqrt{x}$, x^2, %	- 7.5	60	yes	yes	no	22
CM 135[2]	Engineer computer	- 7.5	100	yes	yes	no	28
CM 105[2]	Table computer with digital indication and printer	- 10	140	yes	no	yes	42
CM 240[2]	Scientific computer with 40 keys	- 7.5	180	yes	yes	no	28
CM-245A[2]	Programmable scientific computer	- 7.5	180	yes	yes	no	40
CM 245B[2]	Computer		100				22

2) 2) p-Kanal-Metal-Hole-Technology with Ion Implantation

Table 5. Clock Circuits

Schaltkreis (a)	Versorgungsspannung V (b)	Eingangsfrequenz Hz (c)	Leistung (d) mW	Symbole (e)	Zeitmesser (f)	Speicherregister (g)	Weckregister (h)	Anzeige (i) Digitron	LED	LCD	Technologie (j)	Anzahl der Anschlüsse (k)
CM 201	−7,5	100000 or 100 or 1	430	6	yes	yes	yes	yes	yes	no	p μR	42
CM 202	−7,5	32768 or 30	250	4	no	yes	yes	yes	yes	yes	p μR	42

Key: (a) circuit (b) supply voltage (c) entry frequency (d) power (e) symbols (f) chronometer (g) store recorder (h) alarm recorder (i) indication (j) technology (k) No. of connections

Table 6. Telephone Circuits

Circuits	Utilization	Supply voltage	Power mW	Store	Technology	No. of connections
CM 911	Touchtone telephone with pulse number switch	− 8.4	16.8	16 numbers	p μR	24
CM 912	Touchtone telephone with pulse number switch	− 5	4	16 numbers	p μR	24
CM 913-1	Touchtone telephone with pulse number switch	− 6	7.2	20 numbers	p-Si-Hole	24
CM 901	Automatic number switch	−14	420	30 participants 8 numbers	p μR	42
CM 913 }	Automatic number switch	−14	350	40 participants	p-Si-Hole	42
CM 903 }			280	20 numbers		42

Electronic Components Development

East Berlin RADIO FERNSEHEN ELEKTRONIK in German Vol 28 No 4, Apr 79 pp 251-252

[Article by Horst Schmied: "Electronic Components in Bulgaria"]

[Text] The manufacture of electronic structural elements started in Bulgaria in the late forties, in connection with the development of a national telecommunications industry. The manufacturing sites of the telecommunications technology were joined by departments of structural element manufacture. In the course of time, the initial structural element departments developed into independent plants. 1970 saw the combination into a governmental industrial organization (Industry Association "Electronic Structural Elements"), which is under the Ministry for Electronics and Electrical Engineering.

Electronics has had considerable effect on the speed of economic development in Bulgaria, on economy and modernization. The production spectrum in electronic structural elements corresponds to the basic national requirements. In the sector of ceramics, foil and electrolyte condensers, as well as of quartz oscillators and filters (including for wrist watches), there is international cooperation. High-voltage selenium rectifiers for television are also manufactured, together with other passive components.

The manufacture of semiconductors started in 1964 under French license with Ge-diodes and Ge-transistors. Added to this were in later years semiconductors on a silicon base (transistors, power diodes, thyristors). This production was taken up with the contribution of two advanced research and development institutes specializing in semiconductor elements. Special mention should here be made of the pnp transistor 2T 6821 (50 V, 500 mA, 600 mW, 60 MHz, metal casing), equivalent to the BC 313 (Poland), or KFY 18 (Czechoslovakia). The newest developments are high-capacity silicon transistors.

Intensive development proceeded with integrated MOS circuits (IS), which turned into a major orientation of the Bulgarian structural element development. Continually new types with increasingly higher degrees of integration have been put into production.

Already by the end of the sixties transistors and simple gate circuits were developed in Bulgaria on the basis of the MOS technology. In 1976, the Institute for Micro-Electronics was founded in Sofia, a special institute for MOS technology. Continuing on the existing SSI and MSI-IS, also LSI and VLSI-IS were developed subsequently. These included the standard stores IS, microprocessor IS and telephone circuits.

Since the development capacity in circuits was concentrated almost exclusively on MOS, there are only few institute productions of bipolar analogous circuits: The differential amplifier IYT 01 to 1YT 03 A, Б in TO-5 casing, the NF amplifier 1YC 01 A to Г in the TO-5 casing, and as a hybrid switch the sinus

generator 2ΓC 02 A for UKW [ultra short wave--VHF] radio devices (Instability $2 \cdot 10^{-5}$ with quartz). Bipolar digital circuits are not manufactured in Bulgaria, those made in Russia and Czechoslovakia are used.

The Bulgarian circuits are used in data-processing facilities and electronic computers, in table and pocket computers and in consumer goods electronics. The manufacture of electronic products rose between 1970 and 1975 two and one half times, the export quadrupled in the same period of time. Of the Bulgarian total export 17 percent goes to electronics and electronic technology, and in the Russian exports this even reaches 25 percent. In addition to exports to socialist countries, there are also such exports into countries of Western Europe. We shall present here the spectrum of Bulgarian MOS circuits verbally.

Technology, Characteristics

In p-channel technology with metal gates, the largest portion of the circuits is manufactured in small p-channel technology with metal gates. The store voltage amounts to -15 V. Added to this must be a newer development, the μR technology (microresistance, ohm resistance diffused in), a development of the Institute for Micro-Electronics (e.g. in the ROM 7200, 7300 and the RAM 8002).

The threshold voltage is lowered through p channel and metal gates with ion implantation This allows a lower feed voltage (applied in the IS pocket computers of the 100 series and in the clock circuits 201, 202).

p-channel with Si gate allows because of the threshold voltage in the order of magnitude of 1 V a feed with -9V, +5V. This makes these circuits in their entry and exit levels compatible with the TTL-circuits (RAM 8001, ROM 7400, PROM 7720).

An n-channel and Si gates achieve a threshold voltage below 1 V and thus a feed voltage of +5V. The circuits of this technology are fully TTL compatible in both the feed voltage and the outer levels (RAM of the 8100 series, ROM 7800, microcomputer system 600).

Table 1 shows a grouping of the connection values with reference to the technology used. The inflow current of the MOS circuits lies at 1 μA. Table 2 shows the MOS circuits manufactured in Bulgaria in numerical sequence with their main characteristics.

Sectors of Utilization

Series 2000	Basic series of universal connecting gates up to 10 entries) and flip-flops for wired logic and peripheral switches of LSI circuits.
Series 3000	Shift recorders of varying storage room numbers for stores, delay lines, frequency dividers

Series 6000	Decoder for binary and decimal decoding.
Series 7000	Set value store with complete inside address decoding (mask-programed, also by request of user), use in electronic computers, terminals, function generators, etc.
Series 8000	Operative store (writing-reading store) with free access. All circuits have a complete inner address decoding. For CM 8001 and CM 8002 direct OR switching-together of several exits is acceptable. Used in electronic computers, micro- and mini computer periphery and terminals, data processing devices, automats, instrument construction, etc.
Series 100 and 240	Computer circuits for portable computers (pocket computers) for battery operation and varying handling and computing volume. For example, the CM 240 is inserted into the scientific pocket computer Elka 240.
Series 500	Universal system for use in computer and control facilities with microprogram control. This series consists of five LSI circuits (1,000 to 1,600 elements per chip) with a feed voltage of -15V. Used, for example, in the table computer Elka 53. Approach of the IS proceeds with a 45 kHz two-phase time. The standard stores CM 7600 and CM 8002 are used to complete this system.
Series 700	Anticipated for the construction of digital measuring automats in device construction, electrical medical technology and nuclear technology. All IS of this series permit an output-side OR switching together. The CM 701 has a 3.5 decade steering counter for digital measuring devices, which operate on the double integration system. The CM 703 is a multiple function circuit for the following uses: 1) Separator freely programmable to a division factor of 1 to 9,999, 2) Counter with programmable counting extent, 3) digital comparator for four-digit decimals, 4) Adder. For a more extensive data volume several SM 703 can be switched together.
Series 400	4-bit microprocessor, consisting of central control and computing unit, for use in measuring automats.
Series 600	8-bit microcomputer system in n channel technology with interface circuits for universal use.
Series 200	Electronic digital clock CM 201 (1,600 transistors, 650 resistances, chip surface 5 mm x 3.6 mm), six-digital, and CM 202, four digits. On the basis of the CM 201, the clocks Chronus 10, Chronus 25 and Chronus 50 are manufactured. Also for manufacture of electronic time meters.

Series 900 — Special circuits for pulse load selection and automatic call sender in the telecommunications technology. The automatic call sender AH 10 was developed on the basis of the CM 901, and is now used in the production program of the telecommunications firm Belogradchik.

Table 1. Connection Values of MOS-IS

Characteristic	Metal Gate	Technology p-channel Si-Gate	n-channel Si-Gate
U_s in V	-15 ± 0.75	-9 ± 0.5 $+5\pm0.25$	$+5\pm0.25$
U_{IL} in V	-7	+0.5 ...+0.65	+0.65...+0.8
U_{III} in V	-2.5	+3	+2.0...+2.2
U_{OL} in V	-14	+0.45	+0.45...+0.8
U_{OH} in V	-1.5	+3.5	+2.2...+2.4

Table 2. MOS Circuits of the Bulgarian People's Republic

Definition	Function	Connections	U_s: P_v: f, t_p
CM 103	4 species computer with $\bar{x}$, x^2, % store	22	-7.5 V; 60 mW
CM 105	IS for portable computer (Exits for digital indication and printer connection)	42	-10 V; 140 mW
CM 135	for engineering computer	28	-7.5 V; 100 mW
CM 201	IS for digital clocks and time meters (input 100 kHz or 1 Hz, output h, min, s) with store and alarm recorder	42	-7.5...-15 V; 450 mW
CM 202	IS for digital clocks, four digits (input 32,768 Hz or 50 Hz)	42	-7.5...-12 V; 250 mW
CM 240	IS for scientific computers (40 keys)	28	-7.5 V; 180 mW
CM 245 A	IS for programmable scientific computers	40	-7.5 V; 180 mW
CM 245 Б	IS for programmable scientific computers	22	-7.5 V; 100 mW
CM 401	Computing unit, output unit	42	
CM 402	Central control unit (4 bit micro process)	42	

Table 2 [Continued]

Definition	Function	Connections	U_s: P_v: f, t_p
CM 421	Slide recorder (statist. 2 x 48 bit)		
CM 501	Output unit (with recorder for multiplex control of digit and segment of seven-segment indications)	42(QIL)	
CM 502	Control unit	42(QIL)	
CM 503	Input unit (from keys)	42(QIL)	
CM 504	Computing unit	42(QIL)	
CM 505	Output unit (to printer)	42(QIL)	
CM 601	Microprocessor (8 bit)		+5 V; 1.2 W; 1 MHz
CM 602	Parallel interface (PIO)		+5 V; 0.65 W; 1 MHz
CM 603	Input asynchronous (Communication with periphery)		+5V; 0.5 W; 0.8 MHz
CM 604	Modem, 0...600 Baud		+5 V; 0.3 W
CM 605	Synchronous serial data interface (SIO)		+5 V; 0.5 W; 0.6 MHz
CM 701	Forward-reverse counter (4 decades with store and decoder multiplexer on 10 exits to the indicator elements)	42	-15 V; 0.3 W
CM 702	Control switching of indicator elements in time multiplex and arithmetic values in digital meters (e.g. control of multiplexer in CM 701)	22	- 15 V; 0.2 W
CM 703	Counter, adder (programmable)	22	-15 V; 0.3 W
CM 901	IS for automatic call sender (30 call numbers to eight numbers)	42	-14 V; 420 mW
CM 911	IS for pulse load selection (Store for 16 numbers)	24	-8.4 V; 17 mW
CM 912	IS for pulse load selection (Store for 16 numbers)	24	-5 V; 4 mW

Table 2 [Continued]

Definition	Function	Connections	U_s: P_v: f, t_p
CM 913-1	IS for pulse load selection (Store for 20 numbers)	24	-6 V; 7 mW
CM 913 CM 903	IS for automatic call sender (40 call numbers to 20 numbers)	42	-14 V; 350 mW; 280 mW
CM 2001	4 Input OR-NOR	8 (R)	-15 V; 7.5 mW
CM 2100	2 input OR (4 inputs)	24(QIL)	
CM 2112	4 input OR (4 inputs)	24(QIL)	
CM 2113	4 input OR (4 inputs)	24(QIL)	- 15 V; 15 mW 0.5 µs
CM 2114	5 2 input NOR-OR	24(QIL)	
CM 2115	2 10 input OR	24(QIL)	
CM 2116	2 10 input NOR	24(QIL)	
CM 2212	4 Master-Slave-Flip-Flops	24(QIL)	-15 V; 30 mW
CM 2301	Ten inverters	24(QIL)	-15 V; 15 mW
CM 3005	Slide recorder (60 + 4) bit	8 (R)	-15 V; 62.5 mW; 5 µs
CM 3006	Slide recorder 128 bit (quasistatic, one phase time)	12	(TTL)
CM 3020	Slide recorder 256 bit (dynamic)	12	(TTL)
CM 3021	Slide recorder 512 bit (dynamic)		
CM 4001	Forward-reverse counter, slide recorder	12(R)	-15 V; 30 mW; 2 µs
CM 4010	Forward-reverse counter, parallel inputs	24(QIL)	-15 V; 30 mW; 2 µs
CM 5001	Decimal binary coder	24(QIL)	-15 V; 30 mW; 4 µs
CM 6000	1-out-16 decoder	24(QIL)	
CM 6001	Binary on BCD recoder	24(QIL)	
CM 6002	Decimal decoder (NOR)	24(QIL)	-15 V; 45 mW; 2 µs
CM 6003	Binary decoder (OR)	24(QIL)	
CM 6004	Decimal decoder (OR)	24(QIL)	

Table 2 [Continued]

Definition	Function	Connec-nections	U_s: P_v: f, t_p
CM 7000	Universal matrix (760 bit, two-step)	24(QIL)	-15 V; 75 mW; 1 μs
CM 7100	Universal matrix (220 bit, one-step)	24(QIL)	-15 V; 75 mW; 1 μs
CM 7200	4 K Bit ROM (1024 x 4 bit or 512 x 8 bit)	24	-15 V; 375 mW; 1.5 μs (TTL)
CM 7300	6 K Bit ROM (512 x 12 bit, static)	24	-15 V; 300 mW, 3 μs
CM 7400	2 K Bit ROM (256 x 8 bit)	24	-9 V; +5 V; 450 mW; 1 μs (TTL)
CM 7600	2 K Bit ROM (512 x 4 bit, static)	24	-15 V; 0.45 W; 1.5 μs (TTL)
CM 7701	Sign generator (ROM, static) (2560 bit, Latin letters, numbers and symbols)	24	-15 V; 0.45 W; 1.5 μs (TTL)
CM 7702	Sign generator (2560 bit, 35 Cyrillic letters, additional signs on customer demand)	24	-15 V; 0.45 W; 1.5 μs (TTL)
CM 7720	2 K Bit PROM (256 x 8 bit)	24	-9 V; +5 V; 700 mW, 1 μs (TTL)
CM 7800	8 K Bit (ROM) 1024 x 8 bit, n channel)	24	+5 V; 650 mW; 0.5 μs
CM 8001	256 bit RAM (256 x 1 bit, static, Chip-enable entry)	16	-9 V; +5 V; 225 mW; 1 μs + 1 μs (TTL)
CM 8002	256 Bit Ram (64 x 4 bit, static)	24	-15 V; 0.3 W; 1.5 μs
CM 8003	512 Bit RAM (128 x 4 bit, quasi static)	24	
CM 8101M	1 K Bit, RAM (1024 x 1 bit, dynamic)	22	180 mW; 160 ns
CM 8102	1 K Bit, RAM (1024 x 1 bit, static)	16	+5 V; 370 mW; 0.5 μs + 1 μs
CM 8104	1 K Bit RAM (256 x 4 bit, static)	22	+5 V; 370 mW; 0.5 μs

Table 2 [Continued]

Definition	Function	Connec-tions	U_s: P_v: f, t_p
CM 8105	4 K Bit RAM (4096 x 1 bit, static)	18	+5 V; 220 mW 0.3 μs + 0.46 μs (TTL)
CM 8107	4 K Bit RAM (4096 x 1 bit, dynamic)	22	12 V; 5 V, -5 V; 680 mW; 0.4 μs + 0.6 μs (TTL)
CM 8111	1 K Bit RAM	18	+5 V; 370 mW;
CM 8112	(256 x 4 bit, static)	16	0.5 μs
CM 8116	16 K Bit RAM (16384 x 1 bit, dynamic)	16	12 V, 5 V, -5 V: 460 mW; 0.4 μs (TTL)

(R) = Round casing (TO 5)

(QIL) = Quadruple in Line casing
The connections are located on the opposite longitudinal sides of the casing, but different from the DIL casing at distances of 1.25 mm within the connecting row. In order to have a distance of 2.5 mm between adjoining connections on the conductor plate, the connection ends transverse to the row are alternatingly bent outwards or inwards by 1.25 mm. In this manner, a total of 4 connection rows forms. Compared with the two row connection sequence, the casing is only half as long.

(TTL) = Input and output levels are TTL compatible.

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U 808 D, Z-80 MICROPROCESSORS' PERFORMANCE IN TESTING ROUTINES COMPARED

East Berlin NACHRICHTENTECHNIK-ELEKTRONIK in German Vol 29 No 1, Jan 79 pp 4-6 manuscript received 15 Sep 78

[Article by U. Fruehauf, Chamber of Technology and L. Geiger, Dresden: "System and Program Structure of Automatic Measuring and Testing Instruments"]

[Text] Descriptors: Automatic measurement instrument, automatic test instrument, information processing, system structure.

1. Tasks and Basic Structure of Automatic Test and Measurement Instruments

The utilization of automatic measurement and testing systems in the laboratory and in various production steps of electronic components and equipment presently belongs among the generally accepted industrial standards. Time and cost advantages were not the only factors responsible for the transition to automatic measurement and test instruments in the electronics industry. The increasing complexity of the functional groups to be tested, and the high level of integration of the components employed as well as the complicated and extensive tests these entail (500 to 5,000 per test unit) make the use of highly sophisticated test hardware and software necessary. The primary tasks are the acceptance and functional testing, as well as quality control and assurance. Despite some differences in the test programs and parameters (TTL, MOS, etc.) which are due to the special properties of the objects to be tested (analog, digital, discrete or integrated components), the basic structure pictured in Figure 1 can be taken as the basis for an automatic measurement and test facility. The configuration and performance of control unit A, which contains microprocessor systems or computers, as well as the input and output units matched to the application conditions (keyboards, printers, punched tape units, magnetic tape cassettes, etc.) determine the scope and complexity of the testing tasks which can be carried out ([1], etc.). The test system costs can be substantially reduced through the utilization of desk-top computers and microprocessor systems instead of small computers. The equipment included in measurement section B is generally programmable in modern automatic devices, predominantly via the bus following the IEC interface ([2], [3], etc.). The structure (components, printed circuit cards, etc.; branching structure, network structure)

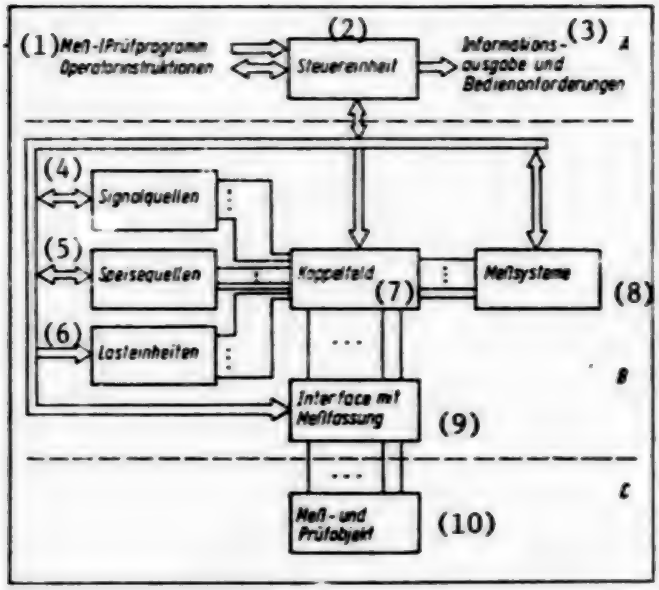


Figure 1. Basic structure of an automated measurement and test instrument.

Key: 1. Measurement and test routines - operator instructions;
2. Control unit;
3. Information output and service requirements;
4. Signal sources;
5. Supply sources;
6. Load units;
7. Coupling field;
8. Measurement system;
9. Interface with measurement formulation;
10. Measurement and test object.

and the parameters of the test object C determine the technical specifications as well as the measurement tasks to be performed and the measurement data processing to be carried out (measurement data compression, document printout, etc.). Special considerations must be given to the creation of particular subroutines due to the measurement data processing which is always required with the testing tasks. Likewise, great value is to be placed on the optimal measurement and testing strategies ([4], [5], etc.).

2. System Structure

The system structure depicted in Figure 2 is optimal for intelligent measurement generators, for measurement equipment and for simple automatic

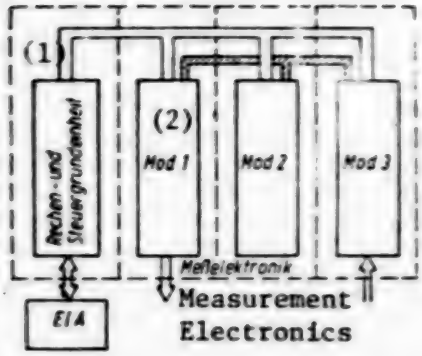


Figure 2. The structure of intelligent measurement and test systems.

Key: 1. Computing and control base unit;
2. Module 1.

E/A = Input/Output

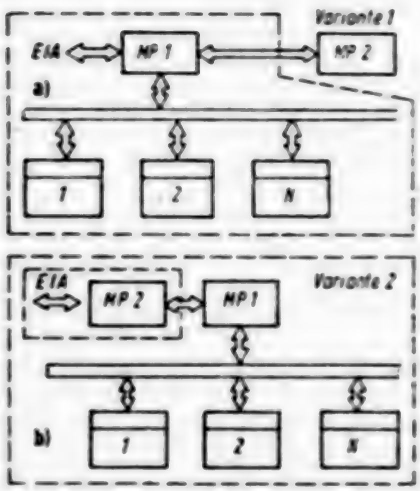


Figure 3. Multiprocessor systems for automated measurement equipment.

measurement and test instruments. The modular structure of the system and the controllability of the system components via a common bus guarantee expandability and adaptation to different tasks. The attainable operational speed and permissible scope of the test routine to be run are basically determined by the cycle time, instruction list and memory capacity of the microprocessor system. This is especially the case when exacting test problems are to be solved through simple measurements and subsequent extensive measurement data processing. An improvement can be achieved if the measurement data processing tasks are turned over to an additional (faster) computer (Figure 3a). In this way, the results are the advantages shown in Table 1. A decisive factor in this case is the fact that through the use of an intelligent input (and occassionally, intelligent measurement systems) the microprocessor system MP1, which acts as a control unit, is freed of extensive measurement data processing routines. This variant is then of particular interset if no sufficiently fast microprocessor components can be utilized. In this case, the service routines and the data processing and output are controlled and executed by the MP2 system though.

TABLE 1

Comparison of the Basic Characteristics of Automatic Measurement and Test Instruments as Shown in Figure 3a or 3b.

Variant 1	Variant 2
Special computer utilization possible for MP2 (selected cycle time, memory capacity, arithmetic logic unit, program system, for example, the realization of $\bar{x}$, σ, etc. and FFT);	MP 1 and MG represent automatic measurement instrument cores.
Routine in MP1, rapid computation in MP2; largely decoupled operation of both microprocessors and separation of automatic measurement instrument control and calculation of the results;	Intelligent input and output. Routines largely independent of MP 1, separation of automatic measurement instrument control and result calculations.
Selection of the optimum operational speeds for MP 1 and MP 2 (for e example, MP 2 is faster than MP 1).	Data processing for input (program selection, matching and service assistance) and output (data retrieval and evaluation system).
	MP 1 and MP 2 of the same order of magnitude as regards operational speed.

3. Program Structure and Measurement Data Processing Routine

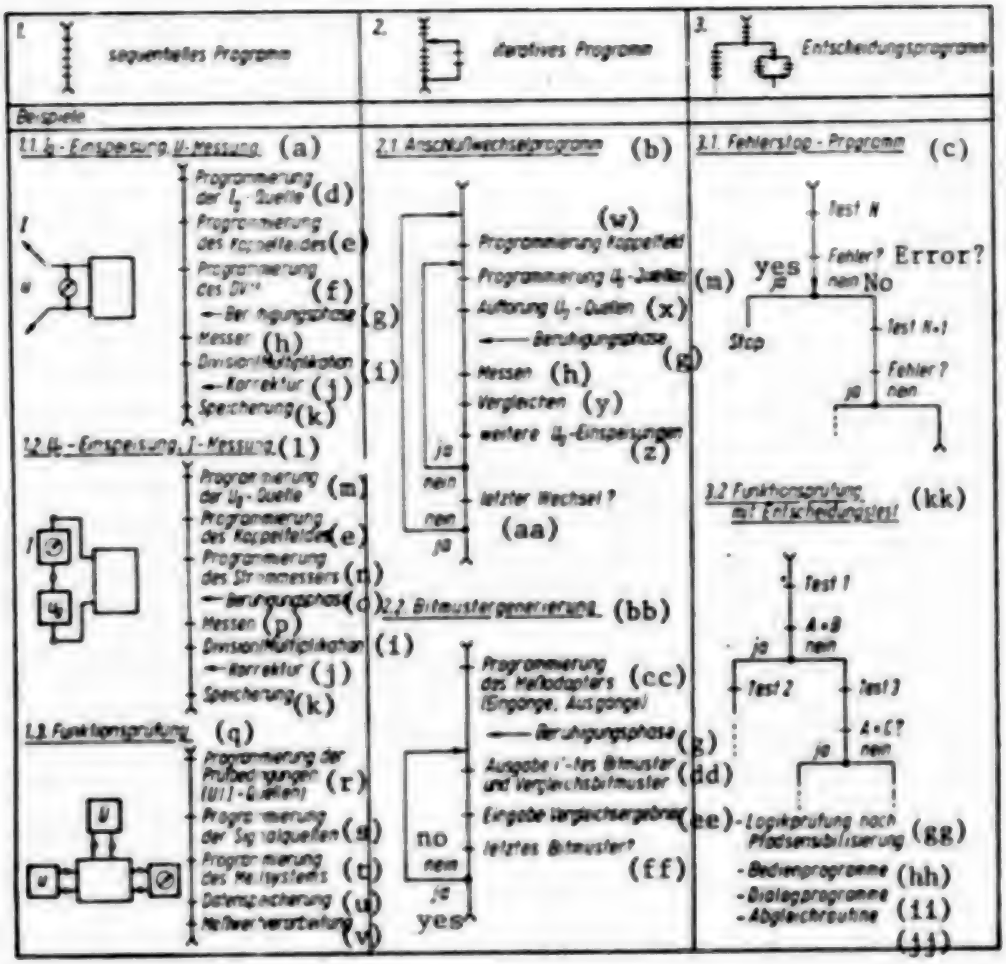
Routines are to be developed for the measurement, testing and measurement data processing tasks which run in sequential, iterative and (or) decision programs (Table 2).

Extensive programs are hybride ones, i.e., they contain program sections of different types. Since automatic measurement and test instruments, because of the use of microprocessors, are generally capable of executing arithmetic operations to a limited extent ([6], [7], etc.), the particular optimal structure is to be chosen for the subroutine. The summary of Table 2 contains guidelines in this respect.

Table 3 provides a simple comparison. Assuming the usual values for the delays in programmable units (settling times: relay switch field, 2.5 milliseconds; source gating, 10 milliseconds; analog-digital converter conversion time: 1 millisecond) and taking the computer time (cycle times) into account, one obtains the results depicted in Figure 4 regarding the percentage of time for individual computer operations in the program run. The differences between the selected types of microprocessors, the

TABLE 2

Basic Program Structures



Key: 1. Sequential program;
2. Iterative program;
3. Branching program;

a. I_0 supply feed, U measurement;
b. Connection change program;
c. Error stop program;
d. Programming of the I_0 source;
e. Programming of the coupling field;
f. Data processing computer;
g. Settling phase;
h. Measurement;
i. Division/multiplication;
j. Correction;
k. Storage;
l. U_0 supply feed, I measurement;
m. Programming of the U_0 source;
n. Programming of the current meter;
o. Settling phase;
p. Measurement;
q. Functional testing;
r. Programming of the test conditions (U and II sources);
s. Programming of the signal sources;
t. Programming of the measurement system;
u. Data storage;
v. Measurement value processing;

[Key to Table 2, continued]:

w. Coupling field programming;
x. Triggering of the U_0 sources;
y. Comparison;
z. Additional U_0 supply feeds;
aa. Last cycle?;
bb. Bit pattern generation;
cc. Programming of the measurement adaptor (inputs, outputs);
dd. Output of the i-th bit pattern and comparison bit pattern;
ee. Input of the comparison result;
ff. Last bit pattern?;
gg. Logic testing following path activation;
hh. Service program;
ii. Dialog program;
jj. Alignment routine;
kk. Functional testing with branching decision test.

TABLE 3

Special Features of the Various Program Structures

Sequential	Iterative	Decision Branching
Easily understandable run;	Determination of subroutines for special tests;	Artificial intelligence;
Little necessary organization;	Parameters are given beforehand with the specific assignment;	Program optimization possible (program curtailment, matching);
Programs largely con constant (lenght/time);	Solution of alignment problems with circuitry;	Address calculations;
Following the running of a partial section or the entire program, the processing of the measurement information can be executed in closed programs.	Store and component unit testing.	Program variation (expansion) very expensive;
		High outlay for the requisite program organization;
		Testing of sensitized paths.

Z-80 and INTEL 8008 or U 808 D during data transfer, in the case of IEC bus control and during measurement data processing are striking. The reversal of the relationships as regards the delays which arise for the computer, which are due to the faster computing speed of the Z-80, is to be noted. Additional routines can be run (conversion, documentation) in

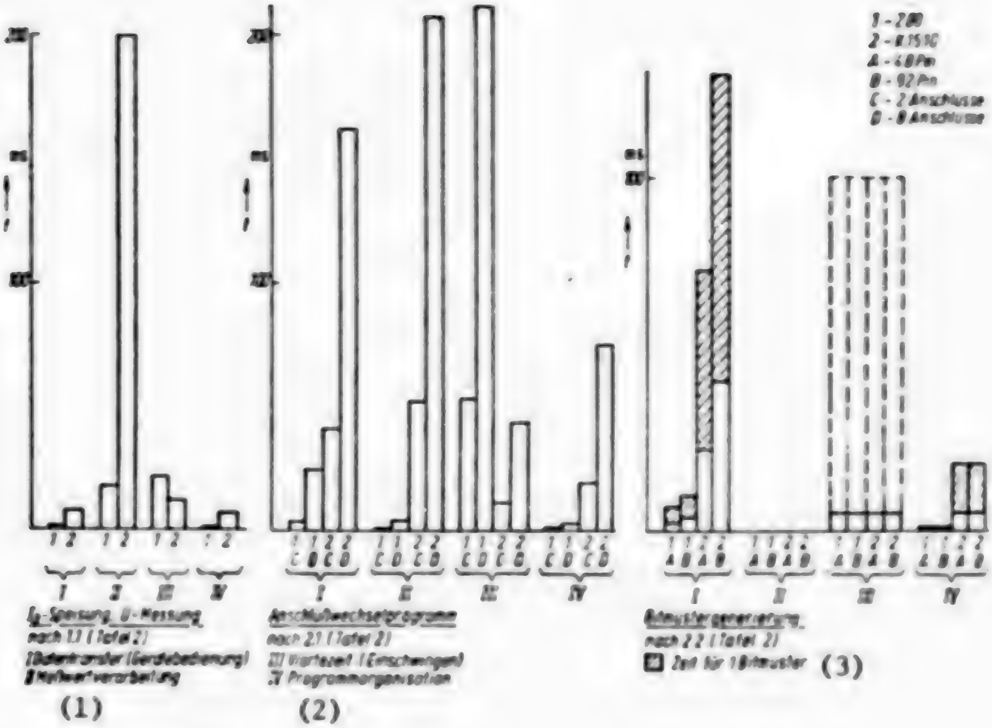


Figure 4. Amounts of time required for individual computational operations during various measurement or testing routines for selected types of microprocessors.

Key:
1. Z 80;
2. K1510;
A. 48 pin;
B. 92 pin;
C. 2 connections;
D. 8 connections;

(1). I_0 feed, U measurement in accordance with 1.1 (Table 2);
I. Data transfer (equipment servicing);
II. Measurement value processing.

(2). Connection changing program in accordance with 2.1 (Table 2);
III. Delay time (transient response);
IV. Program organization.

(3). Bit pattern generation in accordance with 2.2 (Table 2), [shaded areas] = time for one bit pattern.

this delay time, however, only conditionally since the delay time is not consistently available. Nonetheless, the result is an overall faster run of the program. The influence of the operational speed of the measurement instrumentation is of decisive significance as regards an effective utilization of the possibilities arising from the microprocessor.

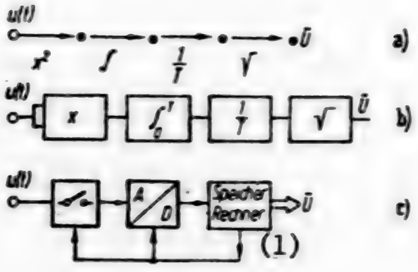


Figure 5. Illustration of the replacement of measurement hardware with measurement software:

a) Operator chain;
b) Hardware solution;
c) Software solution;

1. Store, computer.

The decision concerning the choice of the mathematical operations to be employed is similar to the problem cited above. The operations contained in Table 4 are the ones predominantly of interest for the measurement instrumentation. Taking special conditions into account, data were also obtained for various microprocessor types for the characteristic computing times and storage requirement. In this way, a selection of the optimal measurement strategies is possible, as the following simple example shows. The determination of the effective value $\tilde{U}$ of a voltage u(t) is based on the following definition in accordance with equation (1):

$$\tilde{U} = \sqrt{\frac{1}{T}\int_0^T u(t)\,dt} \qquad (1)$$

The following mathematical operations are required (Figure 5a): the generation of $u^2(t)$, integration, mean value generation (division by the period T), and taking the square root. On one hand, the entire sequence can be realized by means of hardware (analog or digital). The requisite circuit engineering outlay in this case results from the exact realization of $u^2(t)$ and the extraction of the square root; the time requirement is based on the transient processes. A possibility of a completely different kind consists in a purely software determination of the effective value, i.e. through scanning and analog to digital conversion (with the analog to digital converters always contained in the automatic measurement and test equipment), storage, and subsequent measurement value processing (Figure 5c). The latter variant is generally not applicable because of the requisite memory capacity requirement and the computing time (about 1 second or 100 milliseconds in the case of the U 808 D or Z 80 for 100 measurement points; without analog to digital conversion); under certain circumstances, the appropriate equipment is not available for the first variant. Practice presently requires a compromise between hardware and software realization of the various operations. A prerequisite for this decision is knowledge of the available equipment and the outlay in the case of the performance of the mathematical operations by the control unit (cf. Table 4). As can be seen from the overview, division, multiplication

and the extraction of a square root involve the greatest programming outlay and should be avoided as much as possible.

TABLE 4. Measurement Data Processing Routines (Time Requirement in ms) Which are Frequently to be Executed by Automatic Measurement and Test Instruments.

			U 808 D[1])	Z-80
1	$y = A x$	Konstantenmultiplikation, Skalierung	48	4,6
	$y = x_1 x_2$	Multiplikation		
2	$y = \frac{x}{A}$	Normierung	65	6,1
	$y = \frac{x_1}{x_2}$	Division		
3	$y = x + A$	Meßwertkorrektur	4 + 1 M	M 0,4 + 0,1
	$y = x_1 + x_2$	Addition		
4	$y = x - A$	Meßwertkorrektur, Offset-Korrektur		(M Stellenunterschied des Exponenten)
	$y = x_1 - x_2$	Differenzbildung, Soll-Ist-Abweichung		
5	$y = \frac{x - A}{A}$	Toleranzbildung, Abweichung (norm.)	71	6,7
	$y = \frac{x - A}{A} 100$	Prozentuale Abweichung	120	11,2
6	$y = \frac{1}{N} \sum_{i=1}^{N} x_i$	Mittelwertbildung	95 + 4,5 N	7 + 0,5 N
7	$y = \sqrt{x}$	Radizieren	450	43
8	$y = x^2$	Quadrieren	48	4,6
9	$y = \ln x$	Logarithmierung, dB-Ausgabe	850	77
10	BCD → GKZ	Konvertierung (ohne Exponenten)[2])	1,2	0,11
11	BCD → GKZ	Konvertierung (mit Exponenten)[2])	1,7	0,15
12	GKZ → BCD	Konvertierung (ohne Exponenten)[2])	10	0,4
13	GKZ → BCD	Konvertierung (mit Exponenten)[2])	18	0,7

(14)

[1]) U 808/K 1510 ohne Kellerbenutzung, GKZ — Gleitkommazahl
[2]) 3 BCD-Stellen Mantisse, 2 BCD-Stellen Exponenten bzw. 10 bit Dual

x Meßwert
y Meßergebnis } 3 Dekaden
A Konstante

[1]) U 808/K 1510 without stack memory utilization, GKZ = floating decimal point.

[2]) Three BCD places for the mantissa, two BCD places for the exponents or ten-bit dual.

x = Measurement value;
y = Measurement result; } Three decades.
A = Constant

Key: 1. Multiplication by a constant, scaling;
2. Normalization;
3. Measurement value correction;
4. Measurement value correction, offset correction, subtraction, specified value--actual value deviation;
5. Tolerance generation, deviation (norm.); Percentage deviation;
6. Mean value determination;

7. Extraction of the square root;
8. Squaring;
9. Finding the logarithm, dB output;
10. Conversion (without exponents)^2;
11. Conversion (with exponents)^2;
12. Conversion (without exponents)^2;
13. Conversion (with exponents)^2;
14. (M place difference in the exponents).

4. Conclusions

Microprocessors allow for a good realization of the occurring control tasks in automatic measurement and test instruments. The execution of mathematical operations of particular interest for measurement data processing is quite expensive in terms of computer time and memory requirements. The transition to multimicroprocessor systems and the hardware realization of the frequently occurring, expensive processing routines with analog or digital circuits, represents a way out of this situation (switched operational amplifiers as special measurement loops or a supplemental arithmetic unit for multiplication, division, etc.). The practical utilization of these possibilities is unavoidable in modern automated measurement instrumentation designs.

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HUNGARY

SEPARATION OF OPIUM ALKALOIDS BY MEANS OF HIGH-PRESSURE LIQUID CHROMATOGRAPHY

Budapest MAGYAR KEMIAI FOLYOIRAT in Hungarian Vol 85 No 8, Aug 79 pp 337-340
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[Abstract] A high-pressure liquid chromatograph, assembled from a Type M3 S4/4 Orlita metering pump, a Type U6K Waters sample dispenser, a Type CE-212 Cecil ultraviolet spectrophotometer (200-450 nm), and a Type OH-814/1 Radelkis plotter, were used with two columns: (1) 250 mm by 4.5 mm packed with 7 μ Partisil (silica gel), operated at a flow rate of 0.9 ml/min at room temperature with a 30:2:1 mixture of methanol, 2N ammonia solution, and 1N ammonium nitrate solution under a pressure of 97-99 kp/cm^2 and (2) 250 mm by 4.0 mm packed with 10 μ Silica RP-18 [reverse-phase silica gel], operated at a flow rate of 2.5 ml/min at room temperature with a 4:6 mixture of acetonitrile and a 0.01N acueous ammonium carbonate. The separation of papaverine (A), narcotine (B), oxicodone (C), tebaine (D), ethylmorphine (E), codeine (F), morphine (G), hydrocodone (H), paracodine (I), hydromorphone (J), and paramorphane (K) was investigated. Between the two columns, all separations could be effected, but certain combinations could be better separated on one column than on the other. For example, H and I could be easily separated on Column (1) but not easily on Column (2) since the retention times were very close on the latter.

On the other hand, B and D could be readily separated on Column (1) but not well on Column (2). The retention factors on Column (1) and Column (2), respectively, of the compounds were: A - 0.0 and 5.07; B - 0.04 and 17.0; C - 0.54 and 5.27; D - 0.85 and 15.6; E - 1.12 and 4.64; F - 1.21 and 2.97; G - 1.32 and 1.25; H - 2.20 and 7.02; I - 2.46 and 4.73; J - 2.65 and 2.14; and K - 2.82 and 1.67. The analytical task determines the column to be used. In pairs difficult to separate, the analysis is not accurate if the concentration of one component is much higher than that of the other. At a given detector sensitivity, the faster-eluting compound can be analyzed at a lower sensitivity than a slower-eluting one. Determination of the alkaloid ratios may contribute to the identification of the origin of the opium. Figures 9, table 1, references 15: 1 German, 1 Hungarian, 1 Russian, and 12 Western.

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